CLAIMS

What is claimed is:

1. A method, a sensor array that employs a parameter to induce a time-varying phase angle φ on an optical signal that comprises a phase generated carrier, the method comprising the step of:

calculating the phase angle φ through employment of only four samples, wherein all the four samples are based on the optical signal.

2. The method of claim 1, wherein the step of calculating the phase angle φ through employment of only the four samples comprises the steps of:

calculating an in-phase term I through employment of one or more of the four samples;

calculating a quadrature term Q through employment of one or more of the four samples; and

calculating the phase angle φ through employment of the in-phase term I and the quadrature term Q.

3. The method of claim 2, further comprising the steps of:

calculating a peak value I_p of the in-phase term I;

calculating a peak value Q_p of the quadrature term Q; and

calculating an operating point that comprises a modulation depth M and a demodulation phase offset β of the phase generated carrier through employment of the peak value I_p of the in-phase term I and the peak value Q_p of the quadrature term Q.

4. The method of claim 1, wherein the phase generated carrier comprises a period T_{pgc}, the method further comprising the step of:

sampling an output signal from the sensor array to obtain the four samples from a same instance of the period T_{pgc}.

5. The method of claim 4, wherein the step of calculating the phase angle φ through employment of only four samples, the samples based on the optical signal comprises the steps of:

calculating an in-phase term I through employment of one or more of the four samples;

calculating a quadrature term Q through employment of one or more of the four samples; and

calculating the phase angle φ through employment of the in-phase term I and the quadrature term Q.

6. The method of claim 5, further comprising the steps of:

calculating a peak value I_p of the in-phase term I;

calculating a peak value Q_p of the quadrature term Q; and

calculating an operating point that comprises a modulation depth M and a demodulation phase offset β of the phase generated carrier through employment of the peak value I_p of the in-phase term I and the peak value Q_p of the quadrature term Q.

7. The method of claim 6, wherein the four samples comprise samples S_0, S_1, S_2, and S_3, wherein the step of calculating the in-phase term I through employment of the one or more of the four samples comprises the step of:

calculating the in-phase term I:

$$I = (S_0 + S_2) - (S_1 + S_3).$$

8. The method of claim 7, wherein the step of calculating the peak value I_p of the in-phase term I comprises the step of:

calculating the peak value I_p of the in-phase term I:

$$I_p(M, \beta) = 2 \cdot B \cdot \left(\cos(M \cdot \sin\beta) - \cos\left(M \cdot \sin\left(\pi/2 + \beta\right)\right)\right).$$

9. The method of claim 8, wherein the step of calculating the quadrature term Q through employment of the one or more of the four samples comprises the step of:

calculating the quadrature term Q:

$$Q = -(S_0 - S_2).$$

10. The method of claim 9, wherein the step of calculating the peak value Q_p of the quadrature term Q comprises the step of:

calculating the peak value Q_p of the quadrature term Q:

$$Q_p(M, \beta) = 2 \cdot B \cdot \sin(M \cdot \sin\beta).$$

11. The method of claim 10, wherein the step of calculating the phase angle φ through employment of the in-phase term I and the quadrature term Q comprises the step of:

calculating the phase angle $\varphi = \text{arctangent}(Q / I)$.

12. The method of claim 8, wherein the step of calculating the quadrature term Q through employment of the one or more of the four samples comprises the step of:

calculating the quadrature term Q:

$Q = -2 * (S_0 - S_2)$.

13. The method of claim 12, wherein the step of calculating the peak value Q_p of the quadrature term Q comprises the step of:

calculating the peak value Q_p:

$$Q_p(M, \beta) = 4 \cdot B \cdot \sin(M \cdot \sin \beta).$$

14. The method of claim 13, wherein the step of calculating the phase angle φ through employment of the in-phase term I and the quadrature term Q comprises the step of:

calculating the phase angle $\varphi = \text{arctangent}(Q / I)$.

15. An apparatus, a sensor array that employs a parameter to induce a time-varying phase angle φ on an optical signal that comprises a phase generated carrier, the apparatus comprising:

a processor component that employs only four samples to calculate the phase angle φ, wherein all the four samples are based on the optical signal.

16. The apparatus of claim 15, wherein the phase generated carrier comprises a period T_{pgc}, wherein the processor component obtains the four samples from an output signal from the sensor array within a same instance of the period T_{pgc}.

17. The apparatus of claim 16, wherein the processor component employs one or more of the four samples to calculate an in-phase term I;

wherein the processor component employs one or more of the four samples to calculate a quadrature term Q;

wherein the processor component employs the in-phase term I and the quadrature term Q to calculate the phase angle φ.

18. The apparatus of claim 17, wherein the processor component calculates a peak value I_p of the in-phase term I;

wherein the processor component calculates a peak value Q_p of the quadrature term Q;

wherein the processor component employs the peak value I_p of the in-phase term I and the peak value Q_p of the quadrature term Q to calculate an operating point that comprises a modulation depth M and a demodulation phase offset β of the phase generated carrier.

19. The apparatus of claim 18, wherein the four samples comprise samples S_0, S_1, S_2, and S_3;

wherein the processor component calculate the in-phase term I:

$I = (S_0 + S_2) - (S_1 + S_3)$;

wherein the processor component calculate the quadrature term Q:

$Q = -(S_0 - S_2)$;

wherein the processor component calculates the phase angle φ:

$\varphi = \text{arctangent} (Q / I)$.

20. The apparatus of claim 19, wherein the processor component calculates the peak value I_p:

$$I_p(M, \beta) = 2 \cdot B \cdot \left(\cos(M \cdot \sin \beta) - \cos\left(M \cdot \sin\left(\pi/2 + \beta\right)\right)\right);$$

wherein the processor component calculates the peak value Q_p:

$$Q_p(M, \beta) = 2 \cdot B \cdot \sin(M \cdot \sin \beta).$$

21. The apparatus of claim 20, wherein the processor component employs the peak value I_p and the peak value Q_p to calculate the operating point that comprises a modulation depth approximately equal to 2.75 radians.

22. The apparatus of claim 21, wherein the processor component employs the peak value I_p and the peak value Q_p to calculate the operating point that comprises a demodulation phase offset approximately equal to 0.5073 radians.

23. The apparatus of claim 18, wherein the only four samples comprise samples S_0, S_1, S_2, and S_3;

wherein the processor component calculate the in-phase term I:

$I = (S_0 + S_2) - (S_1 + S_3)$;

wherein the processor component calculate the quadrature term Q:

$Q = -2 \cdot (S_0 - S_2)$;

wherein the processor component calculates the phase angle φ:

$\varphi = \text{arctangent} (Q / I)$.

24. The apparatus of claim 23, wherein the processor component calculates the peak value I_p:

$$I_p(M, \beta) = 2 \cdot B \cdot \left(\cos(M \cdot \sin\beta) - \cos\left(M \cdot \sin\left(\pi/2 + \beta\right)\right)\right);$$

wherein the processor component calculates the peak value Q_p:

$$Q_p(M, \beta) = 4 \cdot B \cdot \sin(M \cdot \sin\beta).$$

25. The apparatus of claim 24, wherein the processor component employs the peak value I_p and the peak value Q_p to calculate the operating point that comprises a modulation depth approximately equal to 2.49 radians.

26. The apparatus of claim 25 wherein the processor component employs the peak value I_p and the peak value Q_p to calculate the operating point that comprises a demodulation phase offset approximately equal to 0.3218 radians.

27. An article, a sensor array that employs a parameter to induce a time-varying phase angle φ on an optical signal that comprises a phase generated carrier, the article comprising:

one or more computer-readable signal-bearing media; and

means in the one or more media for calculating the phase angle φ through employment of only four samples, the four samples based on the optical signal.

28. The article of claim 27, wherein the phase generated carrier comprises a period T_{pgc}, the article further comprising:

means in the one or more media for sampling an output signal from the sensor array to obtain the four samples from a same instance of the period T_{pgc}.

29. The article of claim 28, wherein the means in the one or more media for calculating the phase angle φ through employment of the only four samples, the four samples based on the optical signal comprises:

means in the one or more media for calculating an in-phase term I through employment of one or more of the four samples;

means in the one or more media for calculating a quadrature term Q through employment of one or more of the four samples; and

means in the one or more media for calculating the phase angle φ through employment of the in-phase term I and the quadrature term Q.

30. The article of claim 29, further comprising:

means in the one or more media for calculating a peak value I_p of the in-phase term I;

means in the one or more media for calculating a peak value Q_p of the quadrature term Q; and

means in the one or more media for calculating an operating point that comprises a modulation depth M and a demodulation phase offset β of the phase generated carrier through employment of the peak value I_p of the in-phase term I and the peak value Q_p of the quadrature term Q.

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